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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/317,536	05/24/1999	BIN ZHAO	97RSS256-DIV	9245

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FARJAMI & FARJAMI LLP
16148 SAND CANYON
IRVINE, CA 92618

EXAMINER

OWENS, DOUGLAS W

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 07/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/317,536

Applicant(s)

ZHAO ET AL.

Examiner

Douglas W Owens

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28-33 is/are allowed.
- 6) ☒ Claim(s) 16-27 and 34-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 3, 2003 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 16, 19, 20, 23, 26 and 34 are rejected under 35 U.S.C. 102(e) as being anticipated by US Published Patent Application, publication No. 2002/0089062 to Saran et al.

Regarding claims 16 and 34 Saran et al. teaches an interconnect (Fig. 2, for example) comprising:

one or more metal lines (15; paragraph [0031]) having gaps therebetween;

low-k material (14; paragraph [0031]) filling all of the gaps between the metal lines and having a height and vertical portions;

a protective layer (13b; paragraph [0030]) over and in direct contact with the metal lines and low-k material;

a dielectric layer (13a; paragraph [0030]) over the protective layer, wherein the dielectric layer has a different composition than the low-k material and the protective layer;

a via (17) in the dielectric layer;

a metal for filling the via (paragraph [0041]);

a second metal layer (11a; paragraph [0041]) over the dielectric layer; and

an opening in the protective layer for allowing the metal via to contact the first metal line.

Regarding claim 19, Saran et al. teaches an interconnect, wherein the protective layer includes a dielectric material.

Regarding claims 20 and 23, Saran et al. teaches an interconnect, wherein the protective layer includes silicon nitride.

Regarding claim 26, Saran et al. teaches an interconnect, wherein the dielectric layer is made of silicon dioxide, the protective layer is silicon nitride, and the low-k material is an organic material.

4. Claims 35 and 36 are rejected under 35 U.S.C. 102(e) as being anticipated by US patent No. 6,222,269 to Usami.

Regarding claim 35, Usami teaches an interconnect (Fig. 1) comprising:

one or more metal lines (3; Col. 11, lines 19 – 22) having gaps therebetween;
low-k material (5; Col. 6, lines 5 – 9) filling the gaps between the metal lines and having a height and vertical portions;
a protective layer (6) formed directly over the metal lines and the low-k material, wherein the protective layer covers the low-k material, and the protective layer includes an oxide (Col. 6, lines 17 – 20);
a dielectric layer (7) formed over the protective layer, wherein the dielectric layer has a different composition than the low-k material the protective layer (Col. 7, lines 50 – 53);
a via in the dielectric layer;
a metal (9; Col. 6, lines 13 – 15) for filling the vias;
a second metal layer (10; Col. 7, lines 5 – 8 and 62 – 65; the upper interconnect is formed in a similar manner to the lower metal interconnect) over the dielectric layer;
and
an opening in the protective layer for allowing the metal vias to contact the first metal lines.

Regarding claim 36, Usami teaches an interconnect, wherein the oxide includes silicon dioxide.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 17, 18, 21, 22, 24, 25, 27, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saran et al.

Regarding claims 17 and 18, Saran et al. does not teach an interconnect wherein the protective layer includes silicon oxide. Silicon oxide is a known material that is commonly used in the art to serve as dielectric protective layers. It would have been obvious to one of ordinary skill in the art to use silicon oxide, since it is a known material that is well-suited for the intended use. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Regarding claim 21, Saran et al. does not teach an interconnect, wherein the protective layer includes silicon carbide. Silicon carbide is a known material in the art, especially well suited for protective layers because of its hardness. It would have been obvious to one of ordinary skill in the art to use silicon carbide, since it is a known material that is well suited for the intended use.

Regarding claim 22, Saran et al. does not teach an interconnect comprising a spacer on the vertical portion of the low-k material. It is common in the art to provide spacers in vias where metal fills are performed for various reasons, including preventing unwanted diffusion and protection of the dielectric material. It would have been obvious to one of ordinary skill in the art to include a spacer since it is desirable to protect the dielectric material, as well as preventing unwanted diffusion of metal impurities.

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Regarding claims 24 and 25, Saran et al. teaches an interconnect, wherein the metal filling the via is tungsten. Saran et al. does not teach an interconnect, wherein first and second metal layer is an aluminum alloy, or wherein the metal in the via is an aluminum alloy. Aluminum alloys are known in the art and desirable for use in interconnect structures because of their low resistivity. It would have been obvious to one of ordinary skill in the art to use aluminum alloys, since they are known materials that are well suited for the intended use.

Regarding claim 27, Saran et al. teaches an interconnect, wherein the dielectric layer is silicon dioxide and the protective layer is silicon nitride. Saran et al. does not teach an interconnect, wherein the low-k material is a porous silicon dioxide. Porous silicon dioxide is known in the art and commonly used in applications where a low-k dielectric is desired. It would have been obvious to one of ordinary skill in the art to use porous silicon dioxide, since it is a known material that is well suited for the intended use.

Regarding claims 35 and 36, Saran et al. teaches an interconnect (Fig. 2, for example) comprising:

- one or more metal lines (15; paragraph [0031]) having gaps therebetween;
- low-k material (14; paragraph [0031]) filling all of the gaps between the metal lines and having a height and vertical portions;
- a protective layer (13b; paragraph [0030]) over and in direct contact with the metal lines and low-k material;

a dielectric layer (13a; paragraph [0030]) over the protective layer, wherein the dielectric layer has a different composition than the low-k material and the protective layer;

a via (17) in the dielectric layer;

a metal for filling the via (paragraph [0041]);

a second metal layer (11a; paragraph [0041]) over the dielectric layer; and

an opening in the protective layer for allowing the metal via to contact the first metal line.

Saran et al. does not teach an interconnect wherein the protective layer includes silicon oxide. Silicon oxide is a known material that is commonly used in the art to serve as dielectric protective layers. It would have been obvious to one of ordinary skill in the art to use silicon oxide, since it is a known material that is well-suited for the intended use.

Allowable Subject Matter

7. Claims 28 – 33 are allowed.

Response to Arguments

8. Applicant's arguments with respect to claims 16 – 27 and 34 have been considered but are moot in view of the new ground(s) of rejection.

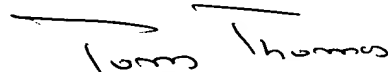
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

A handwritten signature in black ink that reads "Tom Thomas". The signature is written in a cursive style with a horizontal line above the first name.

TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

DWO
June 27, 2003